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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/083,613	02/26/2002	David F. Bliss	AFB00614	3162

7590 02/21/2003
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EXAMINER

SONG, MATTHEW J

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 02/21/2003

4

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/083,613

Applicant(s)

BLISS ET AL.

Examiner

Matthew J Song

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 15-19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☐ Claim(s) ____ is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-14, drawn to a method, classified in class 117, subclass 84.
- II. Claims 15-19, drawn to an apparatus, classified in class 118, subclass 715.

2. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus as claimed can be used to practice another and materially different process, such as a process where metal nitride is formed at a pressure greater than 760 Torr, for example a process at 770 Torr.

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Thomas Stover on 2/5/2003 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-14. Affirmation of this election must be made by applicant in replying to this Office action. Claims 15-19 are

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withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-8 and 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaudo et al (US 6,156,581) in view of Yanashima et al (US 5,993,542).

Vaudo et al teaches a method of forming a (gallium, aluminum, indium) nitride base layer on a substrate by halide vapor phase epitaxy (HVPE), note entire reference. Vaudo et al also teaches in the HVPE process, HCl is passed over a source of high purity gallium to form GaCl, which is transported to a deposition zone where it reacts with ammonia to form GaN (col 10, ln 15-67). Vaudo et al also teaches subatmospheric pressure conditions, 50 Torr, employed during growth and further reductions in growth pressure are expected to improve uniformity across the wafer and across multiple wafers within one growth run (col 12, ln 25-40). Vaudo et al also teaches a vessel 64 of molten indium, a vessel 69 of molten gallium and a vessel 67 of molten aluminum (col 11, ln 1-40).

Vaudo et al does not teach contacting a heated metal with hydrogen iodide or iodine vapor.

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In a method of hydride vapor phase epitaxy, note entire reference, Yanashima et al teaches a hydride vapor phase epitaxy apparatus (Fig 2), where a boat 15 containing Ga and HCl intact to form GaCl, which reacts with NH_3 to form GaN on a substrate (col 6, ln 1-67). Yanashima et al also teaches hydride gases usable for hydride vapor phase epitaxy are HCl, HF, HBr and HI (col 3, ln 5-35). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Vaudo et al with Yanashima et al's HI vapor because substitution of known equivalents for the same purpose is held to be obvious. (MPEP 2144.06).

Referring to claim 2-4, Vaudo et al teaches subatmospheric pressures. Vaudo et al does not teach the claimed range of pressure. Overlapping ranges are held to be obvious (MPEP 2144.05).

Referring to claim 5, Vaudo et al teaches Ga, Al and In.

Referring to claim 6, Vaudo et al teaches (Ga, Al, In)N.

Referring to claim 7, the combination of Vaudo et al and Yanashima et al teach the MI is formed in one locale and then is flowed to another locale to react with ammonia to form MN ('581 Fig 2 and '542 Fig 2).

Referring to claim 8, the combination of Vaudo et al and Yanashima et al teach deposition on a substrate 56, 1.

Referring to claims 13-14, the combination of Vaudo et al and Yanashima et al teach the same reactants and products as applicant, therefore the reaction chemistry is inherently the same as claimed.

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7. Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaudo et al (US 6,156,581) in view of Yanashima et al (US 5,993,542) as applied to claims 1-8 and 13-14 above, and further in view of Jain (US 4,910,163).

The combination of Vaudo et al and Yanashima et al teach all of the limitations of claim 9, as discussed previously, except iodine is placed in a first boat upstream in an elongated first container below an inlet for H₂ or HI.

Jain teaches a chemical vapor deposition apparatus, where a continuous tubular reactor is divided into three zones. Jain also teaches in the first zone an iodine boat contains iodine crystals and a resistance heater to elevate the temperature so that iodine is vaporized and admixes with a carrier gas of hydrogen, in the center of the reactor is packed with silicon and in the last zone contains a substrate (col 2, ln 20 to col 3, ln 67). Jain also teaches the iodine and carrier gas passes through the silicon and the iodine reacts with silicon to produce silicon diiodide, which then exits as a part of the gas stream and the silicon diiodide is disproportionated and silicon is deposited on a substrate (col 1, ln 50-67). Jain also teaches the apparatus permits removal and insertion of reactants and removal of product as the process continuous for continuous processing (col 1, ln 1-45 and col 4, ln 1-25). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al and Yanashima et al with Jain's apparatus with iodine in first boat upstream because the apparatus permits removal and insertion of reactants and removal of product as the process continuous for continuous processing, thereby increasing productivity.

Conclusion

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8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Shimoyama et al (US 5,868,834) teaches a vapor phase epitaxy process, where there is no particular restriction on the halide gas or halogen gas, for example, HI or I₂ can be used (col 2, ln 1-67).

Shimoyama et al (US 5,827,365) teaches HI and I₂ are equivalents for manufacturing III-V semiconductors (col 2, ln 30-40 and col 3, ln 1-20).

Steele (US 4,279,670) teaches a container 110 for producing iodide vapor and the iodide vapor is passed through zinc arsenide to form a reactive substance, which deposits on a gallium arsenide substrate (col 4, ln 40-60 and col 7, ln 1-67).

Moon et al (US 3,856,585) teaches a hydrogen halide is used as a transporting gas and is passed over a III-V source material and deposition takes place on a substrate (abstract).

Vaudo et al (US 2002/0166502) teaches a (Ga,Al,In)N deposition using HVPE involving the reaction of HCl and ammonia at pressure of from about 10-800 Torr ([0048]-[0053]).

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

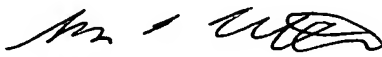
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on 703-308-3868. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song
Examiner
Art Unit 1765

MJS
February 19, 2003



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